PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 16 June 2000 (16.06.00)	
International application No. PCT/SG99/00105	**Applicant's or agent's file reference** SY5000276WOC
International filing date (day/month/year) 26 October 1999 (26.10.99)	**Priority date** (day/month/year) 28 October 1998 (28.10.98)
Applicant HO, Anthony, Tung, Shuen et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

17 May 2000 (17.05.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer S. Mafla
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

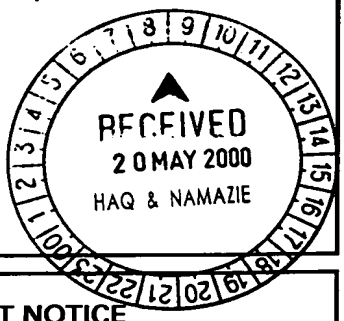
From the INTERNATIONAL BUREAU

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:
NAMAZIE, Farah
Haq & Namazie Partnership
Robinson Road
P.O. Box 765
Singapore 901515
SINGAPOUR



Date of mailing (day/month/year) 04 May 2000 (04.05.00)	
Applicant's or agent's file reference SY5000276WOC	**IMPORTANT NOTICE**

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/SG99/00105	26 October 1999 (26.10.99)	28 October 1998 (28.10.98)

Applicant
DATAMARK TECHNOLOGIES PTE LTD. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,CN,JP,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   CA,EP,ID,SG

   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   04 May 2000 (04.05.00) under No. WO 00/25203

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer
J. Zahra

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

84/TC

From the INTERNATIONAL BUREAU

PCT

INFORMATION CONCERNING ELECTED OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

To:

NAMAZIE, Farah
Haq & Namazie Partnership
Robinson Road
P.O. Box 765
Singapore 901515
SINGAPOUR

Date of mailing (day/month/year) 16 June 2000 (16.06.00)	
Applicant's or agent's file reference SY5000276WOC	**IMPORTANT INFORMATION**
International application No. PCT/SG99/00105	**International filing date** (day/month/year) 26 October 1999 (26.10.99)
Priority date (day/month/year) 28 October 1998 (28.10.98)	
Applicant DATAMARK TECHNOLOGIES PTE LTD. et al	

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

   EP :AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE
   National :AU,CA,CN,JP,KR,US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

   National :ID,SG

3. The applicant is reminded that he must enter the "national phase" **before the expiration of 30 months from the priority date** before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing , if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

   Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

   The entry into the European regional phase is postponed **until 31 months from the priority date** for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer:
S. Mafla

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SY5000276WOC	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/SG 99/00105	International filing date *(day/month/year)* 26 October 1999	(Earliest) Priority Date *(day/month/year)* 28 October 1998

Applicant
1: DATAMARK TECHNOLOGIES PTE LTD et al.

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of **4** sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

☐ **Certain claims were found unsearchable** (See Box I).

3. ☒ **Unity of invention is lacking** (See Box II).

4. With regard to the **title,**

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

☒ the text is approved as submitted by the applicant

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. **1**

☒ as suggested by the applicant.

☐ None of the figures

☐ because the applicant failed to suggest a figure

☐ because this figure better characterizes the invention

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/SG 99/00105

Box 1 Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-8 are directed to a method of generating a pseudo-random number sequence, where a starting position of an array of digits is first selected, the digits are then regrouped with reference to the selected starting position so as to form a pseudo-random number.

2. Claims 9-48 are directed to an encoding / decoding method, where a key element is generated by performing an operation between each primary data element with a secondary data element.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG 99/00105

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: G06F 7/58, H04L 9/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC G06F 7/-, H04L 9/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96/42151 A (THE DICE COMPANY) 27 December 1996 pages 14-19	9-11, 17, 21-23, 25, 37-41, 43
A	US 5276738 A (HIRSCH) 4 June 1994 Whole document	9-48
A	EP 301383 A (ADVANTEST CORPORATION) 19 July 1988 Whole document	1-8

☐ Further documents are listed in the continuation of Box C

☒ See patent family annex

* Special categories of cited documents:

"A" Document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 January 2000	11 FEB 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No.: (02) 6285 3929	Authorized officer **J. LAW** Telephone No.: (02) 6283 2179

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SG 99/00105

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	96/42151	EP	872073	US	5613004	US	5687236
US	5276738	EP	614147				
EP	301383	JP	1036212	US	5901264	JP	1036213

END OF ANNEX

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference

SY5000276WOC

Box No. I TITLE OF INVENTION

METHODS OF DIGITAL STEGANOGRAPHY FOR MULTIMEDIA DATA

Box No. II APPLICANT

Name and address:

DATAMARK TECHNOLOGIES PTE LTD

SUITE 106, INNOVATION CENTRE, BLOCK 1
16 NANYANG DRIVE, SINGAPORE 637722
REPUBLIC OF SINGAPORE

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(i.e. country)* of nationality: **SINGAPORE**

State *(i.e. country)* of residence: **SINGAPORE**

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address:

HO, ANTHONY TUNG SHUEN

54H NANYANG VIEW
#09-16
SINGAPORE 639669
REPUBLIC OF SINGAPORE

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: **CANADA**

State *(i.e. country)* of residence: **SINGAPORE**

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ Agent ☐ common representative

Name and address:

1. Namazie, Farah
2. Haq, Murgiana
3. Haq, Tasneem
4. Loke, Adrian

of

HAQ & NAMAZIE PARTNERSHIP
Robinson Road, P.O. Box 765
Singapore 901515
Republic of Singapore

Telephone No. **(65) 438 6613**

Facsimile No. **(65) 438 7383 , (65) 438 7393**

Teleprinter No

☐ Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondences should be sent.

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet is not to be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)*

TAM SIU CHUNG

78B ENG KONG PLACE
SINGAPORE 599154
REPUBLIC OF SINGAPORE

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: **SINGAPORE**

State *(i.e. country)* of residence: **SINGAPORE**

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address:

TAN Siong Chai

Blk 426, Fajar Road
#01-545, Singapore 670426
Republic of Singapore

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: **SINGAPORE**

State *(i.e. country)* of residence: **SINGAPORE**

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address:

YAP Lian Teck

Blk 312, Bukit Batok Street 32
#11-79, Singapore 650312
Republic of Singapore

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: **SINGAPORE**

State *(i.e. country)* of residence: **SINGAPORE**

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address:

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality:

State *(i.e. country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

- [ ] Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☐ **AP** **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☐ **EA** **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP** **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☐ **OA** **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)*: .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☐	AL	Albania	☐	LS	Lesotho
☐	AM	Armenia	☐	LT	Lithuania
☐	AT	Austria	☐	LU	Luxembourg
☒	AU	Australia	☐	LV	Latvia
☐	AZ	Azerbaijan	☐	MD	Republic of Moldova
☐	BA	Bosnia and Herzegovina	☐	MG	Madagascar
☐	BB	Barbados	☐	MK	The former Yugoclav Republic of Macedonia
☐	BG	Bulgaria			
☐	BR	Brazil	☐	MN	Mongolia
☐	BY	Belarus	☐	MW	Malawi
☒	CA	Canada	☐	MX	Mexico
☐	CH and LI	Switzerland and Liechtenstein	☐	NO	Norway
☒	CN	China	☐	NZ	New Zealand
☐	CU	Cuba	☐	PL	Poland
☐	CZ	Czech Republic	☐	PT	Portugal
☐	DE	Germany	☐	RO	Romania
☐	DK	Denmark	☐	RU	Russian Federation
☐	EE	Estonia	☐	SD	Sudan
☐	ES	Spain	☐	SE	Sweden
☐	FI	Finland	☒	SG	Singapore
☐	GB	United Kingdom	☐	SI	Slovenia
☐	GD	Grenada	☐	SK	Slovakia
☐	GE	Georgia	☐	SL	Sierra Leone
☐	GH	Ghana	☐	TJ	Tajikistan
☐	GM	Gambia	☐	TM	Turkmenistan
☐	HR	Croatia	☐	TR	Turkey
☐	HU	Hungary	☐	TT	Trinidaad and Tobago
☒	ID	Indonesia	☐	UA	Ukraine
☐	IL	Israel	☐	UG	Uganda
☐	IN	India	☒	US	United States of America
☐	IS	Iceland	☐	UZ	Uzbekistan
☒	JP	Japan	☐	VN	Viet Nam
☐	KE	Kenya	☐	YU	Yugoslavia
☐	KG	Kyrgyzstan	☐	ZW	Zimbabwe
☐	KP	Democratic People's Republic of Korea			
☒	KR	Republic of Korea			
☐	KZ	Kazakhstan			
☐	LC	Saint Lucia			
☐	LK	Sri Lanka			
☐	LR	Liberia			

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

☐ .....
☐ .....
☐ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
Item (1) 28.10.98	9803458-0	SINGAPORE		
Item (2)				
Item (3)				

[X] The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (*only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office*) identified above as item(s) : (1)

**Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(If two or more International Searching authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*
ISA / AU

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*
Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST

This international application contains the following **number of sheets:**

request	:	4
description (excluding sequence listing part)	:	20
claims	:	8
abstract	:	1
drawings	:	7
sequence listing part of description	:	0
Total number of sheets	:	**40**

This international application is **accompanied by** the item(s) marked below:

1.	X	fee calculation sheet
2.	×	separate signed power of attorney (× 5)
3.		copy of general power of attorney; reference number, if any:
4.		statement explaining lack of signature
5.		priority document(s) identified in Box No. VI as item(s):
6.		translation of international application into (language):
7.		separate indications concerning deposited microorganism or other biological material
8.		nucleotide and/or amino acid sequence listing in computer readable form
9.		other *(specify):*

Figure of the drawings which should accompany the abstract: FIG. 1

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Farah Namazie
Agent

For receiving Office use only

1. Date of actual receipt of the purported international application:
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purpose international application:
4. Date of timely receipt of the required Corrections under PCT Article 11(2):
5. International Searching Authority Specified by the applicant: **ISA /**
6. ☐ Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy By the International Bureau:

This sheet is not part of and does not count as a sheet of the international application.

PCT

FEE CALCULATION SHEET
Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's file reference

Applicant

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE	135	T	
2. SEARCH FEE	875	S	

International search to be carried out by **AU**
(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains **40** sheets.

first 30 sheets	712	b1	
10 remaining sheets x **16** additional amount =	160	b2	
Add amounts entered at b_1 and b_2 and enter total at B	872	B	

Designation Fees

The international application contains **9** designations.

9 number of designation fees payable *(maximum 11)* x **164** amount of designation fee =	1476	D	
Add amounts entered at B and D and enter total at I	2668	I	

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT *(if applicable)*	50	P	
5. TOTAL FEES PAYABLE	3408		
Add amounts entered at T, S, I and P, and enter total in the TOTAL box.	TOTAL		

☐ The designation fees are not paid at this time.

Mode of Payment

☐	authorization to charge deposit account *(see below)*	☐ bank draft	☐ coupons
☒	cheque	☐ cash	☐ other *(specify)*:
☐	postal money order	☐ revenue stamps	

Deposit Account Authorization *(this mode of payment may not be available at all receiving Offices)*

The RO/ _____

☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☐ is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☐ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

Deposit Account Number	Date *(day/month/year)*	Signature

See Notes to the fee calculation sheet

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF RECEIPT OF RECORD COPY

(PCT Rule 24.2(a))

To:

NAMAZIE, Farah
Haq & Namazie Partnership
Robinson Road
P.O. Box 765
Singapore 901515
SINGAPOUR

Date of mailing (day/month/year)	IMPORTANT NOTIFICATION
23 November 1999 (23.11.99)	
Applicant's or agent's file reference	**International application No.**
SY5000276WOC	PCT/SG99/00105

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

DATAMARK TECHNOLOGIES PTE LTD. (for all designated States except US)
HO, Anthony, Tung, Shuen et al (for US)

International filing date	:	26 October 1999 (26.10.99)
Priority date(s) claimed	:	28 October 1998 (28.10.98)
Date of receipt of the record copy by the International Bureau	:	17 November 1999 (17.11.99)
List of designated Offices	:	

EP :AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE
National :AU,CA,CN,ID,JP,KR,SG,US

RECEIVED
DEC 1999
HAQ & NAMAZIE

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- [X] time limits for entry into the national phase
- [X] confirmation of precautionary designations
- [ ] requirements regarding priority documents

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer:

Ingrid Aulich

Telephone No. (41-22) 338.83.38

INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated in the Notification of Receipt of Record Copy (Form PCT/IB/301) by paying national fees and furnishing translations, as prescribed by the applicable national laws.

The time limit for performing these procedural acts is **20 MONTHS** from the priority date or, for those designated States which the applicant elects in a demand for international preliminary examination or in a later election, **30 MONTHS** from the priority date, provided that the election is made before the expiration of 19 months from the priority date. Some designated (or elected) Offices have fixed time limits which expire even later than 20 or 30 months from the priority date. In other Offices an extension of time or grace period, in some cases upon payment of an additional fee, is available.

In addition to these procedural acts, the applicant may also have to comply with other special requirements applicable in certain Offices. **It is the applicant's responsibility** to ensure that the necessary steps to enter the national phase are taken in a timely fashion. Most designated Offices do not issue reminders to applicants in connection with the entry into the national phase.

For detailed information about the procedural acts to be performed to enter the national phase before each designated Office, the applicable time limits and possible extensions of time or grace periods, and any other requirements, see the relevant Chapters of Volume II of the PCT Applicant's Guide. Information about the requirements for filing a demand for international preliminary examination is set out in Chapter IX of Volume I of the PCT Applicant's Guide.

GR and ES became bound by PCT Chapter II on 7 September 1996 and 6 September 1997, respectively, and may, therefore, be elected in a demand or a later election filed on or after 7 September 1996 and 6 September 1997, respectively, regardless of the filing date of the international application. (See second paragraph above.)

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

CONFIRMATION OF PRECAUTIONARY DESIGNATIONS

This notification lists only specific designations made under Rule 4.9(a) in the request. It is important to check that these designations are correct. Errors in designations can be corrected where precautionary designations have been made under Rule 4.9(b). The applicant is hereby reminded that any precautionary designations may be confirmed according to Rule 4.9(c) before the expiration of 15 months from the priority date. If it is not confirmed, it will automatically be regarded as withdrawn by the applicant. There will be no reminder and no invitation. Confirmation of a designation consists of the filing of a notice specifying the designated State concerned (with an indication of the kind of protection or treatment desired) and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.

REQUIREMENTS REGARDING PRIORITY DOCUMENTS

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 16 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 16-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 16-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity to furnish the priority document within a time limit which is reasonable under the circumstances.

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 16-month time limit is the filing date of the earliest application whose priority is claimed.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

NAMAZIE, Farah
Haq & Namazie Partnership
Robinson Road
P.O. Box 765
Singapore 901515
SINGAPOUR

Date of mailing (day/month/year) 23 November 1999 (23.11.99)	
Applicant's or agent's file reference SY5000276WOC	**IMPORTANT NOTIFICATION**
International application No. PCT/SG99/00105	International filing date (day/month/year) 26 October 1999 (26.10.99)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 28 October 1998 (28.10.98)
Applicant DATAMARK TECHNOLOGIES PTE LTD. et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.

3. An **asterisk(*)** appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

4. The **letters "NR"** appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
28 Octo 1998 (28.10.98)	9803458-0	SG	17 Nove 1999 (17.11.99)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

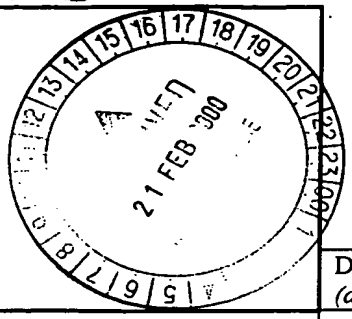
Ingrid Aulich

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
Haq & Namazie Partnership
Robinson Road, P.O. Box 765
Singapore 901515
Republic of Singapore



PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

	Date of mailing *(day/month/year)* 11 FEB 2000
Applicant's or agent's file reference SY5000276WOC	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/SG 99/00105	International filing date 26 October 1999

Applicant
1. DATAMARK TECHNOLOGIES PTE LTD et al.

[X] The applicant is hereby notified that the international search report has been established and is transmitted herewith

Filing of amendments and statement under Article 19:
The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the international search report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. [ ] **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

[ ] the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

[ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau.

If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later)

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No.: (02) 6285 3929	**J. LAW** Telephone No. (02) 6283 2179

(See notes on accompanying sheet)

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under Article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasised that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, eg. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Preliminary Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When? Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How? Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

(i) the claim is unchanged;
(ii) the claim is cancelled;
(iii) the claim is new;
(iv) the claim replaces one or more claims as filed;
(v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."

2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."

3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."

4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under Article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequences if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/IPEA/401).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see the *PCT Applicants Guide*, Volume II.

TC/54

PCT/SG99/00105

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING THE FILING OF AMENDMENTS OF THE CLAIMS

(PCT Administrative Instructions, Section 417)

To:

NAMAZIE, Farah
Haq & Namazie Partnership
Robinson Road
P.O. Box 765
Singapore 901515
SINGAPOUR

Date of mailing (day/month/year) 13 April 2000 (13.04.00)	
Applicant's or agent's file reference SY5000276WOC	**IMPORTANT NOTIFICATION**
International application No. PCT/SG99/00105	**International filing date** (day/month/year) 26 October 1999 (26.10.99)
Applicant DATAMARK TECHNOLOGIES PTE LTD. et al	

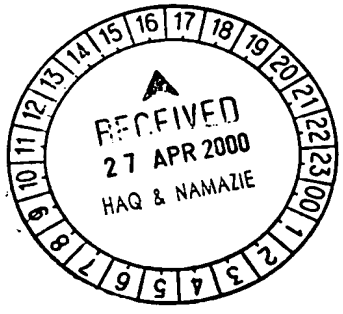
1. The applicant is hereby notified that amendments to the claims under Article 19 were received by the International Bureau on:

   08 April 2000 (08.04.00)

2. This date is within the time limit under Rule 46.1.

   Consequently, the international publication of the international application will contain the amended claims according to Rule 48.2(f), (h) and (i).

3. The applicant is reminded that the international application (description, claims and drawings) may be amended during the international preliminary examination under Chapter II, according to Article 34, and in any case, before each of the designated Offices, according to Article 28 and Rule 52, or before each of the elected Offices, according to Article 41 and Rule 78.



The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorised officer

Jocelyne Rey-Millet
Telephone No.: (41-22) 338.83.38

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below :

IPEA / AU

CHAPTER II

PCT
DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of International preliminary examination according to the Patent Corporation Treaty and hereby elects all eligible States (except where otherwsie indicated).

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference: **SY5000276WOC**

International application No.	International filing date *(day/month/year)*	(Earliest) Priority date *(day/month/year)*
PCT/SG99/00105	**26 October 1999 (26.10.99)**	**28 October 1998 (28.10.98)**

Title of invention:
METHODS OF DIGITAL STEGANOGRAPHY FOR MULTIMEDIA DATA

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)*

DATAMARK TECHNOLOGIES PTE LTD

SUITE 106, INNOVATION CENTRE, BLOCK 1
16 NANYANG DRIVE
SINGAPORE 637722
REPUBLIC OF SINGAPORE

Telephone No.:

Facsimile No.:

Teleprinter No.:

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
SG	**SG**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

HO, ANTHONY TUNG SHUEN

54H NANYANG VIEW, #09-16, SINGAPORE 639669, REPUBLIC OF SINGAPORE

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
CA	**SG**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

TAM SIU CHUNG

78B ENG KONG PLACE, SINGAPORE 599154, REPUBLIC OF SINGAPORE

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
SG	**SG**

[X] Further applicants are indicated on a continuation sheet.

International application No.
PCT/SG99/00105

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not to be included in the demand.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

TAN SIONG CHAI

BLK 426, FAJAR ROAD, #01-545, SINGAPORE 670426, REPUBLIC OF SINGAPORE

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
SG	**SG**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

YAP LIAN TECK

BLK 312, BUKIT BATOK STREET 32, #11-79, SINGAPORE 650312, REPUBLIC OF SINGAPORE

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:
SG	**SG**

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(i.e. country)* of nationality:	State *(i.e. country)* of residence:

☐ Further applicants are indicated on a continuation sheet.

International application No.
PCT/SG99/00105

Box No. III AGENT OF COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is [X] agent [ ] common representative

and [X] has been appointed earlier and represents the applicant(s) also for international preliminary examination.

[ ] is been appointed and any earlier appointment of (an) agent(s) / common representative is hereby revoked.

[ ] is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s) / common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)*

NAMAZIE, FARAH
HAQ, MURGIANA
HAQ, TASNEEM
LOKE, ADRIAN

OF HAQ & NAMAZIE PARTNERSHIP
ROBINSON ROAD POST OFFICE,
P.O. BOX 765, SINGAPORE 901515
REPUBLIC OF SINGAPORE

Telephone No.:
65 438 6613

Facsimile No.:
65 438 7383 / 65 438 7393

Teleprinter No.:

[ ] **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the International Preliminary Examining Authority **to start on the basis of:**

   [X] the international application as originally filed

   the description [X] as originally filed
   [ ] as amended under Article 34

   the claims [ ] as originally filed
   [X] as amended under Article 19 (together with any accompanying statement)
   [ ] as amended under Article 34

   the drawings [X] as originally filed
   [ ] as amended under Article 34

2. [ ] The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. [ ] The applicant wishes the start of the international preliminary examination **to be postponed** until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receive a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: ENGLISH

[X] which is the language in which the international application was filed.

[ ] which is the language of a translation furnished for the purposes of international search.

[ ] which is the language of publication of the international application.

[ ] which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby **elects all eligible states** *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes **not to elect:**

International application No.
PCT/SG99/00105

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

					For International Preliminary Examining Authority use only	
					received	not received
1.	translation of international application	:	-	sheets	☐	☐
2.	amendments under Article 34	:	-	sheets	☐	☐
3.	copy (or, where required, translation) of amendments under Article 19	:	8	sheets	☐	☐
4.	copy (or, where required, translation) of statement under Article 19	:	-	sheets	☐	☐
5.	letter	:	1	sheets	☐	☐
6.	other *(specify)*	:	-	sheets	☐	☐

The demand is also accompanied by the item(s) marked below :

1. [X] fee calculation sheet
2. [ ] separate signed power of attorney
3. [X] copy of general power of attorney; reference number, if any
4. [ ] statement explaining lack of signature
5. [ ] nucleotide and or amino acids listing in computer readable form
6. [X] other *(specify)*: **bank draft**

Box No. VII SIGNATURE OF APPICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and capacity in which the person signs (if such capacity is not obvious from reading the demand).

Namazie, Farah
Agent

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. [ ] The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. [ ] The applicant has been informed accordingly.
4. [ ] The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. [ ] Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

See Notes to the demand form

PCT

CHAPTER II

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

International application No.	PCT/SG99/00105
Applicant's or agent's file reference	SY5000276WOC

For International Preliminary Examination Authority use only

Date stamp of the IPEA

Applicant

DATAMARK TECHNOLOGIES PTE LTD, et al.

Calculation of prescribed fees

1. Preliminary examination fee ..... AUD 450 P

2. Handling fee *(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (for all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.* ..... AUD 238 H

3. Total of prescribed fees
Add the amounts entered at P and H and enter total in the TOTAL box ..... AUD 688 TOTAL

Mode of Payment

- ☐ authorization to charge deposit account with the IPEA (see below)
- ☐ cash
- ☐ cheque
- ☐ revenue stamps
- ☐ postal money order
- ☐ coupons
- ☒ bank draft
- ☐ others *(specify)*:

Deposit Account Authorization *(this mode of payment may not be available at all IPEAs)*

The IPEA/ _____ ☐ is hereby authorized to charge the total fees indicated above to my deposit account.

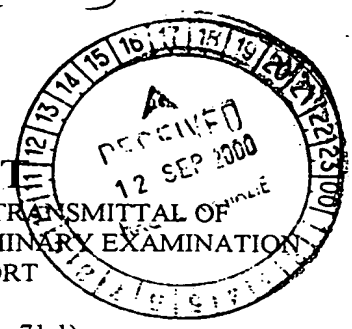
☐ *(this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)* is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

Deposit Account Number _____ Date *(day/month/year)* _____ Signature _____

See Notes to the fee calculation sheet

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY



To:

Haq & Namazie PartnershipRobinson Road, P.O. Box 765Singapore 901515Republic of Singapore

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

	Date of mailing *day/month/year* 28 AUG 2000
Applicant's or agent's file reference SY5000276WOC	**IMPORTANT NOTIFICATION**

International application No.	International filing date	Priority date
PCT/SG99/00105	26 October 1999	28 October 1998

Applicant
DATAMARK TECHNOLOGIES PTE LTD et al

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translations to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide

Name and mailing address of the IPEA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	J. LAW Telephone No. (02) 6283 2179

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SY5000276WOC	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. **PCT/SG99/00105**	International filing date *(day/month/year)* 26 October 1999	Priority Date *(day/month/year)* 28 October 1998

International Patent Classification (IPC) or national classification and IPC

Int. Cl. [7] G06F 7/58, H04L 9/20

Applicant

DATAMARK TECHNOLOGIES PTE LTD et al

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 8 sheet(s).

3. This report contains indications relating to the following items:

I	[X]	Basis of the report
II	[ ]	Priority
III	[ ]	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	[ ]	Lack of unity of invention
V	[X]	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	[ ]	Certain documents cited
VII	[ ]	Certain defects in the international application
VIII	[ ]	Certain observations on the international application

Date of submission of the demand	Date of completion of the report
17 May 2000	17 August 2000
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer J. LAW Telephone No. (02) 6283 2179

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
[redacted]/SG99/00105

I. Basis of the report

1. With regard to the **elements** of the international application:*

- [ ] the international application as originally filed.
- [X] the description, pages **1-20,** as originally filed,
  pages , filed with the demand,
  pages , received on with the letter of
- [X] the claims, pages , as originally filed,
  pages , as amended (together with any statement) under Article 19,
  pages , filed with the demand,
  pages **21-28,** received on **7 August 2000** with the letter of **7 August 2000**
- [X] the drawings, pages **1-7,** as originally filed,
  pages , filed with the demand,
  pages , received on with the letter of
- [ ] the sequence listing part of the description:
  pages , as originally filed
  pages , filed with the demand
  pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

- [ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- [ ] the language of publication of the international application (under Rule 48.3(b)).
- [ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:

- [ ] contained in the international application in written form.
- [ ] filed together with the international application in computer readable form.
- [ ] furnished subsequently to this Authority in written form.
- [ ] furnished subsequently to this Authority in computer readable form.
- [ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- [ ] The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. [ ] The amendments have resulted in the cancellation of:
   - [ ] the description, pages
   - [ ] the claims, Nos.
   - [ ] the drawings, sheets/fig.

5. [ ] This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

International application No.
[redacted]T/SG99/00105

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-43	YES
	Claims		NO
Inventive step (IS)	Claims	1-43	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-43	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Claims 1-43

The invention of the amended claims is an encoding method where the generation of key elements involves the regrouping of an array of digits, which represent the primary data, with reference to a selected starting position so as to form a pseudo-random number sequence.

No individual citation or obvious combination of citations disclose the above step.

The closest art of:

WO 96/42151 A

is a method for encoding additional information into a stream of digital samples where the keys used in the encoding process are generated by a cryptographically secure random process.

CLAIMS

1. An encoding method including steps of:

(a) providing primary data including a pseudo-random number sequence, the step of providing primary data including steps of:

(i) providing an ordered plurality of first data elements, the content of each first data element being represented by a group of digits;

(ii) reading the groups of digits into an array such that each position in the array contains one of said digits;

(iii) selecting a starting position within the array of digits; and

(iv) regrouping said digits to form new groups of digits with reference to the starting position such that each new group represents a pseudo-random number and successive new groups represent said pseudo-random number sequence;

(b) providing secondary data including a plurality of second data elements; and

for each second data element,

(c) performing an operation with a first data element, and

(d) generating a key element as a result of said operation;

wherein each operation is performed and each key element is generated without degrading said primary data.

2. An encoding method according to claim 1 including, prior to performing said operations, a step of:

rearranging the first data elements of the primary data.

3. An encoding method according to claim 2 wherein a plurality of techniques for rearranging the first data elements is available and at least one selection is made from the plurality of techniques.

4. An encoding method according to claim 3 wherein the or each selection is made randomly or pseudo-randomly.

5. An encoding method according to claim 3 wherein the or each selection is made by a user.

6. An encoding method according to claim 3 including steps of:

storing the key elements in a key file; and

storing information about the or each selected rearranging technique in an attribute section of the key file.

7. An encoding method according to claim 2 wherein the first data elements are rearranged in a predefined manner.

8. An encoding method according to claim 2 wherein the first data elements are rearranged in a random or pseudo-random manner.

9. An encoding method according to claim 1 including, prior to performing said operations, a step of:

rearranging the second data elements of the secondary data.

10. An encoding method according to claim 1 wherein the primary data is in the form of a primary data array containing the first data elements and the secondary data is in the form of a secondary data array containing the second data elements, further including a step of:

resizing the primary data array to match the size of the secondary data array.

11. An encoding method according to claim 10 wherein resizing includes a step of:

if the secondary data array is smaller than the primary data array, truncating the primary data array, and

if the secondary data array is larger than the primary data array, repeating first data elements of the primary data array.

12. An encoding method according to claim 11 including, prior to performing said operations, a step of rearranging the first data elements of the primary data array according to a first technique, and rearranging the repeated first data elements according to said first technique or further techniques other than said first technique.

13. An encoding method according to claim 1 wherein the first and second data elements are represented by numbers and wherein each operation includes a mathematical operation between the first and second data elements.

14. An encoding method according to claim 1 wherein the first and second data elements are represented in binary notation and each operation includes a logical operation between the first and second data elements.

15. An encoding method according to claim 1 wherein the first and second data elements are represented by numbers and each operation is a mapping function.

16. An encoding method according to claim 1 wherein the first and second data elements are represented by numbers and each operation is a 1:1 mapping function wherein the content of each second data element is used as an index for selecting a first data element and the content of each selected first data element is assigned to the associated key element.

17. An encoding method according to claim 1 wherein a plurality of operations is available and a selection is made from the plurality of operations.

18. An encoding method according to claim 17 wherein the selection is made randomly or pseudo-randomly.

19. An encoding method according to claim 17 wherein the selection is made by a user.

20. An encoding method according to claim 1 including a step of storing the key elements in a key file.

21. An encoding method according to claim 20 including a step of storing information about the encoding process within an attribute section of the key file.

22. An encoding method according to claim 21 wherein the information stored in the attribute section includes the operation or operations performed.

23. An encoding method according to claim 20 including a step of storing the primary data in the key file.

24. A method according to claim 1, wherein said method for generating said pseudo-random number sequence includes a step of storing said pseudo-random number sequence.

25. A method according to claim 1 wherein the first data elements are represented in binary notation.

26. A method according to claim 25 wherein each new group of digits includes eight binary digits.

27. A method according to claim 1 wherein the starting position is selected randomly or pseudo-randomly.

28. A method according to claim 1 wherein the starting position is selected in a pre-defined manner.

29. An encoding method according to claim 1 wherein the primary data includes a random number sequence generated by a random number generator.

30. An encoding method according to claim 1 wherein the primary data is provided from a file obtained from the Internet.

31. An encoding method according to claim 30 including steps of:
storing the key elements in a key file; and
storing information about the Internet file in an attribute section of the key file.

32. An encoding method according to claim 1 wherein the secondary data includes a text message and each second data element includes a character from a character set.

33. An encoding method according to claim 1 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a digital audio sample.

34. An encoding method according to claim 1 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a still image element.

35. An encoding method according to claim 1 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a motion video element.

36. A method of decoding secondary data including a plurality of second data elements, said secondary data being encoded in a plurality of key elements generated by an operation performed with a respective first data element of primary data, wherein each operation is formed and each key element is generated without degrading said primary data, said method including steps of:

(a) providing said primary data including a pseudo-random number sequence generated by a method including steps of:

(i) providing an ordered plurality of first data elements, the content of ~~each data~~ element being represented by a group of digits;

(ii) reading the groups of digits into an array such that each position in the array contains one of said digits;

(iii) selecting a starting position within the array of digits; and

(iv) regrouping said digits to form new groups of digits with reference to the starting position such that each new group represents a pseudo-random number and successive new groups represent said pseudo-random number sequence;

(b) providing said plurality of key elements; and

(c) for each key element, generating a corresponding said second data element by performing an inverse of said operation.

37. A method according to claim 36 wherein during encoding of the secondary data, the first data elements are rearranged according to a defined technique prior to performing the operations, said method including, prior to generating said second data elements, a step of:

rearranging the first data elements of the primary data according to said defined technique.

including, prior to generating said second data elements, a step of rearranging the first data elements of the primary data array according to said first technique, and rearranging the repeated first data elements according to said first technique or said further techniques.

42. A method according to claim 36 wherein the key elements are provided in a key file having an attribute section and the attribute section contains information about the operations performed during the encoding of the secondary data, said method including a step of reading said information from the attribute section for determining for each key element said inverse of said operation.

43. A method according to claim 36 wherein during encoding of the secondary data, the primary data is provided from a file obtained from the Internet, and the key elements are provided in a key file having an attribute section which contains information about the Internet file, said method including a step of reading said information from the attribute section for retrieving said Internet file.

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
G06F 7/58, H04L 9/20

A1

(11) International Publication Number: WO 00/25203

(43) International Publication Date: 4 May 2000 (04.05.00)

(21) International Application Number: PCT/SG99/00105

(22) International Filing Date: 26 October 1999 (26.10.99)

(30) Priority Data:
9803458-0 28 October 1998 (28.10.98) SG

(71) Applicant *(for all designated States except US)*: DATAMARK TECHNOLOGIES PTE LTD. [SG/SG]; Suite 106, Innovation Centre, Block 1, 16 Nanyang Drive, Singapore 637722 (SG).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: HO, Anthony, Tung, Shuen [CA/SG]; 54H Nanyang View #09-16, Singapore 639669 (SG). TAM, Siu, Chung [SG/SG]; 78B Eng Kong Place, Singapore 599154 (SG). TAN, Siong, Chai [SG/SG]; Block 426, Fajar Road #01-545, Singapore 670426 (SG). YAP, Lian, Teck [SG/SG]; Block 312, 32 Bukit Batok Street #11-79, Singapore 650312 (SG).

(74) Agents: NAMAZIE, Farah et al.; Haq & Namazie Partnership, Robinson Road, P.O. Box 765, Singapore 901515 (SG).

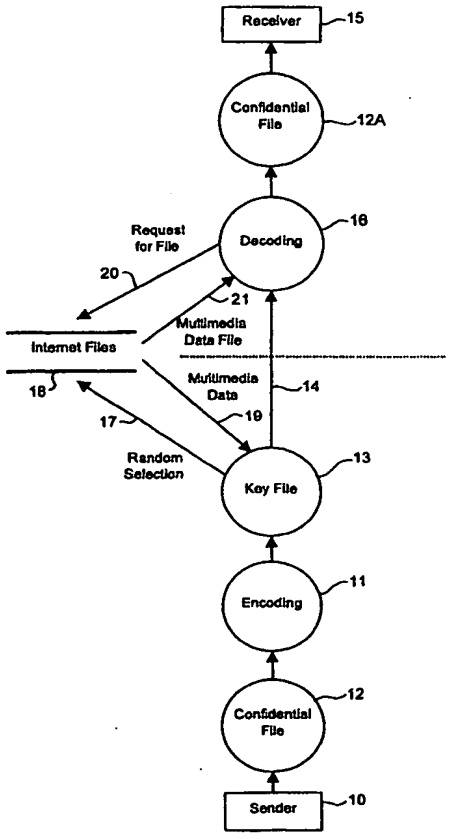
(81) Designated States: AU, CA, CN, ID, JP, KR, SG, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
With amended claims.

(54) Title: METHODS OF DIGITAL STEGANOGRAPHY FOR MULTIMEDIA DATA

(57) Abstract

A lossless steganographic encoding method for secure transmission or storage of multimedia data. Primary data, such as text, image, video, audio or other digital data, is utilised in a steganographic process to encode secondary data, such as text, image, video, audio or other digital data. The primary data includes a plurality of first data elements and the secondary data includes a plurality of second data elements. For each second data element an operation is performed with a first data element so as to generate a key element as a result of the operation. The key elements may then be securely transmitted and/or stored. In preferred embodiments of the method, the primary data may be rearranged according to a predefined or random manner, or it may be resized so as to match the size of the secondary data. A complementary decoding method is disclosed, and a method of generating a pseudo-random number sequence, which may be used in the steganographic and decoding methods, is also disclosed.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

METHODS OF DIGITAL STEGANOGRAPHY FOR MULTIMEDIA DATA

Field of the Invention

The present invention relates generally to steganographic methods of encoding digital data for secure transmission or storage of information. The invention also relates to complementary decoding methods and to a method of generating a pseudo-random number sequence using any digital file. The pseudo-random number sequence may be used in the steganographic encoding or decoding methods.

The encoding method is especially suited to digital camouflaging or steganography for confidential information such as text, audio, still image or video data, and it will be convenient to describe the method in relation to that example application. It should be appreciated, however, that the encoding method is intended for broader application and use. Similarly, the method of generating a pseudo-random number sequence may be used in applications other than steganography applications.

Background of the Invention

The tremendous growth in multimedia products and services provided via the Internet and digital data storage media (DSM) has led to the need for copyright authentication and for protecting data integrity. In the past few years, a number of digital watermarking techniques have been developed for the purpose of resolving legal use issues associated with copyright information on the Internet and DSM.

A number of digital watermarking techniques have recently been patented. Examples of these include US Patent 5,636,292 to Rhoads (1997) and US Patent 5,659,726 to Sandford and Handel (1997). Rhoads discloses methods to impress an identification code on a carrier, such as an electronic data signal or a physical medium, in a manner that permits the identification code to be later discerned and the carrier thereby identified. Sandford and Handel disclose a method of embedding auxiliary information into host data, such as a photograph,

television signal, facsimile transmission, or identification card. The method operates by manipulating a noise component of the host data in accordance with the auxiliary information.

Many prior art digital watermarking techniques, including the techniques disclosed in the above US patents, are only able to conceal limited information, such as a few logical bits (ie. "1" and "0") or a few characters (eg. "A12"), in the host data. However, to record detailed ownership information for a host work in which copyright subsists, such as a satellite image of Singapore, an entire message or sentence may need to be concealed in, or associated with, the host data. For example, the sentence "Digital image of Singapore is the property of Mr John Tan, dated 16 December 1997" may provide more conclusive proof as to true ownership of the host work than having to rely on just a simple code to assess copyright infringement.

There therefore remains a need for a steganographic encoding method which may allow a relatively long string of secondary data (such as text, image, audio or video data) to be encoded using primary data (such as text, image, audio or video data) without degradation of the primary data.

Besides the above mentioned application on the Internet, many potential consumer, commercial and service applications may benefit from the use of digital steganography technology, including for copyright protection and signature authentication purposes and for secure transmission of information. These applications include steganographic encoding of secured text, image, audio or video data containing ownership identification or attribute information associated with digital still or video cameras, copyright protection and royalty tracking of sound recordings in the music industry. Commercial and service sectors may also benefit from secure transmission and reception of confidential information and digital signature associated with sensitive documents and electronic transactions that could be encoded in normal data streams transmitted through an open channel.

Pseudo-random number generators are algorithms or devices that give a fixed sequence of random numbers when the seed is the same. This seed may be a number, a bit-stream, a digital file or any other form of data.

Typical random number generators use hashing functions for example, SHA (secure hash algorithm), as in US Patent Number 5,787,179 awarded to Microsoft Corporation (1998), and US Patent Number 5,732,138 awarded to Silicon Graphics Inc. (1998).

Summary of the Invention

In one aspect, the present invention provides a method of generating a pseudo-random number sequence including the steps of:

providing source data including an ordered plurality of data elements, the content of each data element being represented by a group of digits;

reading the groups of digits into an array such that each position in the array contains one of said digits;

selecting a starting position within the array of digits; and

regrouping said digits to form new groups of digits with reference to the starting position, such that each new group represents a pseudo-random number and successive new groups represent said pseudo-random number sequence.

In one embodiment the data elements of the source data are represented in binary notation and the content of each data element is preferably represented by a byte (ie. 8 bits). In this embodiment, each bit of each 8-bit byte constitutes a digit which may be read into a bit array such that each position in the array contains one bit.

The starting position may be selected randomly, pseudo-randomly or in a pre-defined manner. Based on that starting position the bits are regrouped into new groups of preferably eight bits, each new group constituting a new byte of information. In this way, each new byte represents a pseudo-random number which bears no numerical relationship to numerical values of the data elements of the source data.

The term "pre-defined" as used throughout this specification refers to that which is defined or can be defined by a user or by the program.

The source data may be obtained from a digital file available in the public domain, a private database, or any digital storage medium (DSM). The file may

represent a text sequence, an image, an audio sequence, a video sequence, a graphics representation, a computer program, or any accessible digital data.

Unlike the abovementioned prior art random number generators which use a hashing function, the present invention uses the whole or part of a digital file. The contents of digital files can be considered as random depending on the location selected for the starting position and how the bits are grouped. As a result, the same digital file with different starting positions and grouping methods will generate completely different pseudo-random number sequences. Different digital files with the same starting position and the same grouping method will also generate completely different pseudo-random number sequences. This has the distinct advantage that it is able to regenerate the same sequence of pseudo-random numbers as long as the same digital file, the same starting position, and the same grouping method are used. Since this method is not based on any mathematical formula, there is no way of obtaining the same sequence of random numbers without knowing the source file, the starting position, and the grouping method.

Advantageously, the pseudo-random number sequence is stored for use in a steganographic data encoding or decoding method, a cryptographic encoding or decoding method, or for any other purpose requiring a sequence of random numbers.

In another aspect, the present invention provides an encoding method including the steps of:

providing primary data including an ordered plurality of first data elements;

providing secondary data including a plurality of second data elements; and

for each second data element

(i) performing an operation with a first data element, and

(ii) generating a key element as a result of said operation.

In one embodiment the encoding method includes, prior to performing said operations, a step of rearranging the first data elements of the primary data. A plurality of techniques for rearranging the first data elements may be available and a selection may be made from the plurality of techniques. The selection may

be made randomly or pseudo-randomly, or by a user. The first data elements may be rearranged in a predefined manner or in a random or pseudo-random manner. Alternatively, or additionally, similar rearranging steps may be performed on the second data elements of the secondary data.

In one embodiment the primary data is in the form of a primary data array containing the first data elements and the secondary data is in the form of a secondary data array containing the second data elements. The encoding method may include a step of resizing the primary data array to match the size of the secondary data array. If the secondary data array is smaller than the primary data array, the primary data array may be truncated to match the size of the secondary data array. If the secondary data array is larger than the primary data array, first data elements of the primary data array may be repeated so as to increase the size of the first data array to match that of the secondary data array. In an embodiment including a rearranging step as well as a resizing step, the repeated first data elements may be rearranged according to techniques other than the technique selected for rearranging the first group of first data elements. In other words, although the first data elements of the primary data may be multiplied, each group of multiplied first data elements need not necessarily be rearranged according to the same technique as the first group of first data elements. Moreover, each repeated group may be arranged according to a different technique.

The operation to be performed between the first and second data elements may include a mathematical operation, a logical operation, a mapping function, or any other operation which serves to generate key elements as a result of the operation. Preferably, a plurality of operations is available and a selection is made from the plurality of operations. The selection may be made randomly or pseudo-randomly, or by a user.

The encoding method may generate a string of key elements which is associated with a corresponding string of second data elements. Unique key data, which is generated for given primary and secondary data, may be stored for use in a complementary decoding method, as described below.

Preferably the key elements are stored in a key file, which may then be

transmitted or archived for future use. Advantageously, information about the encoding process, such as the operation performed, the rearranging technique, etc., is also stored in the key file. This information may be stored within a header or attribute section of the key file. An attribute section may be positioned anywhere in the key file, not necessarily at the beginning.

The source, primary, secondary and key data mentioned above may be represented in digital binary form. However, any form of data representation or notation, using any convenient set of symbols, may be used, eg. alphanumeric characters, integer numbers, etc. The primary data may represent or be derived from a still image, motion video, audio, text or other type of information. Likewise, the secondary data may represent a still image, motion video, audio, text or other information.

In a preferred form of the invention, the secondary data includes a text message and each second data element includes an alphanumeric character. However, each secondary data element may include a character from another character set. The alphanumeric characters may be used to compose the text message. In a typical application of the invention the text message may include confidential information relating to an image, a video or an audio sequence contained in the primary data. In one embodiment, the text message may include one or more of the following: a title, an artist, a copyright holder, a body to which royalties should be paid, and general terms of publisher distribution.

In other embodiments, the text message may be a confidential message, a representation of an image, a representation of an audio sequence, or a combination of the above.

The primary data may represent a text message, a still image, an audio sequence, a motion video segment, general multimedia data, a graphics file, a complete program, or any other accessible digital data that can be retrieved from the public domain, such as an Internet website, a private database, the random access memory or buffer of a computer, or any digital storage medium. The first data elements of the primary data may be arranged in an array.

Each first data element may define a characteristic associated with a still image element. The first data elements may be obtained from a stream of data

representing a digitised still image. The image may be obtained from an Internet web site, a digital camera, a computer game, computer software or other source. It may be a greyscale or color image (wherein each first data element defines a grey level or colour component, for example) and may be stored in any known format, eg. BMP, GIF, TIFF, or JPEG.

Alternatively, or additionally, each first data element may define a characteristic associated with a motion video element. The first data elements may be obtained from a stream of data representing digitised motion video. The digitised video may be obtained from an Internet web site, a Video Compact Disc (VCD) player, a Laser Disc (LD) player, a computer game, computer software, a Digital Versatile Disc (DVD) player or other source, and may be stored in any known format, eg. MPEG or AVI.

Alternatively, or additionally, each first data element may define a characteristic associated with a digital audio sample. The digital audio samples may be obtained from a stream of data representing digitised sound or music. The digitised sound may be obtained from an Internet web site, a Compact Disc (CD) player, Digital Audio Tape (DAT) player, Laser Disc player, Video Compact Disc (VCD) player or other source, and may be stored in any known format eg. WAV, AIFF, MIDI, etc. In one embodiment, the digital audio samples are obtained from two streams of data representing two channels of digitised sound for stereo reproduction.

In the preferred embodiment of the encoding method, the primary data includes a random or pseudo-random number sequence. The still image, motion video or audio data mentioned in the preceding three paragraphs may be used as source data for generating a pseudo-random number sequence according to the method described above. That number sequence, based on the original image, video or audio data, may then be used as primary data in the encoding method of the invention.

In an alternative embodiment, the primary data may be obtained from a conventional random-number generator or other suitable source.

In another aspect, the present invention provides a method of decoding secondary data including a plurality of second data elements, said secondary

data being encoded in a plurality of key elements such that each key element is generated by an operation performed with a respective first data element of primary data, said method including the steps of:

providing said primary data including an ordered plurality of said first data elements;

providing said plurality of key elements;

for each key element, generating a corresponding said second data element by performing an inverse of said operation.

Compared with existing steganographic or digital watermarking techniques the present invention has the distinct advantage that long sentences of text, large amounts of data of any form, e.g. images, audio, video, or any binary files, may be encoded and subsequently decoded in confidence. With any form of data, e.g. images, audio, video, binary files, digital bit patterns, the integrity of the primary data is never affected or compromised in any way. As such, the primary data may be transmitted by any means e.g. by mail, e-mail, telephone, fax, ftp, http, dial-up networking, local area network, wide area network, Internet, Intranet, Extranet, or by any other electronic means. The data can also be retrieved from any storage medium, such as hard disk, floppy disk, zip disk, CD ROM, DAT, VCD, DVD. In a preferred way, since the primary data is never modified, there is no need to re-send the primary data for every message. Only the key data has to be sent. Therefore, this method results in lower bandwidth usage and faster transmission via a communication channel when compared to any existing steganographic or watermarking technique.

In an alternative embodiment, when access to open or stored data, eg. Internet, CD ROM, VCD or DVD, etc., is restricted or limited at the receiving end of the transmission channel, the primary or source data (in whole or in part) may also be sent as part of the key file. This embodiment of the invention offers a lower level of security but may be preferred by some users for its convenience. To improve security in this embodiment, a password or other protection may be implemented in conjunction with the invention. This embodiment of the invention can then form part of a larger system for transmitting confidential information.

In a modified version of the latter embodiment, the primary or source data

(in whole or in part) may be sent as a separate file with proper identification.

Brief Description of the Drawings

The accompanying drawings, which are incorporated into and constitute part of the description of the invention, illustrate embodiments of the invention and serve to explain the principles thereof. It is to be understood, however, that the drawings and following detailed description are given for the purposes of illustration only and are not intended as a definition of the limits of the invention.

In the drawings:

Figure 1 shows a context diagram showing an example application of the invention for confidential data transmission;

Figure 2 shows a flow-chart of a preferred embodiment of the invention incorporating a two-part steganographic encoding method;

Figure 3 shows an example of rearranging a primary data file for use in the steganographic encoding method;

Figure 4 shows an example of a mathematical operation;

Figure 5 shows an example of a logical XOR operation between primary and secondary data;

Figure 6 shows an example of a 1:1 mapping operation; and

Figure 7 shows an example of the steganographic encoding method performed on a password.

Description of Preferred Embodiments

A preferred embodiment of the invention uses source or primary data, such as a still image, motion video, audio, text or other data, to steganographically encode secondary data, such as a data file containing confidential information. The confidential information may likewise include a still image, motion video, audio, text or any other type of data. The encoding process generates unique key data representing the secondary data in an encoded form.

One embodiment of the invention, to be described in detail below, includes two main processes. The first main process uses source data, such as a still

image, motion video, audio, text or other data, to generate an array containing a pseudo-random number sequence. That array of pseudo-random numbers is then used as primary data in a second main process to steganographically encode the secondary data.

The source data may be provided as a file containing the image, video, audio, text or other data. For ease of description, this file will be referred to as the Container File. Similarly, the secondary data may be provided as a file which, for ease of description, will be referred to as the Confidential File. The key data may also be stored to a file, which will be referred to as the Key File.

Referring now to Figure 1, there is shown a preferred embodiment of the invention used for secure transmission of confidential data over an open communication channel. The sender 10 performs a steganographic encoding process 11 on a Confidential File 12 so as to generate a unique Key File 13 which may be securely transmitted over the open communication channel 14. The receiver 15 of the Key File 13 performs a complementary decoding process 16 on that file to retrieve the Confidential File 12A.

To steganographically encode the Confidential File 12, either the sender 10 or the encoding process 11 selects 17 from the Internet 18 a data file to be downloaded 19 for use as the Container File in the encoding process 11. After performing the encoding process 11 and generating the Key File 13, the sender 10 can transmit the Key File 13 to the receiver 15 over the open channel 14. The receiver 15 can then send a request 20 to the Internet 18 to download 21 the same Container File at his/her end and perform the decoding process 16 on the Key File 13.

The sender 10 and receiver 15 may have agreed on a particular Internet file to use as the Container File in the encoding and decoding processes. Alternatively, the Key File 13 may carry information on where to find the Internet file used by the sender.

As mentioned above, the Container File and Confidential File may contain any types of data. Accordingly, one can choose to encode a video file using an audio file, an image file using a text file, or any other combination. The invention does not constrain the user to a particular combination.

Referring now to Figure 2, there is shown a flowchart illustrating in more detail the two-part staganographic encoding process of the preferred embodiment of the invention. Steps 30-32 relate to the first main process for generating an array of pseudo-random numbers based on source data (Container File) and steps 33-37 relate to the second main process of steganographically encoding secondary data (Confidential File) using the array of pseudo-random numbers as primary data to generate key data (Key File).

Main Process 1

This process generates an array of pseudo-random numbers based on a source file containing digital data.

In step 30, a digital source file (Container File) containing a plurality of bytes of data is read into an array of bits. The source file may be any type of file containing any type of information, eg. audio, video, image, text, etc.

In step 31, one of the elements of the bit array is selected as a starting position. This selection may be made in a random or pseudo-random manner or in a predefined manner.

In step 32, the elements of the bit array are regrouped into new groups of bytes (8 bits) beginning from the starting position. In this manner, the resulting new groups represent pseudo-random numbers in a sequence which may be stored as an array.

It should be appreciated that this process is applicable to number systems other than one based on two (ie. binary). That is, the digital information carried in the source data need not necessarily be converted into bits. If the information is converted into a decimal system, or a number system with a base of 16, etc., the same principle may be applied to create new random numbers.

The regrouping step performed in step 32 need not always regroup the bits into new groups of eight. Supposing the binary system is used, and the array of bits is regrouped into bytes, the range of the generated random numbers will be from 0 to 255. If instead the bits are regrouped into nibbles (4 bits), the range will be narrower (0-15). For a larger range, the groups can be made

larger. For other number base systems, the size of the groups chosen may similarly be varied.

Because this process is not confined to any particular medium, the user has a very large number of files to choose from and use as the Container File. Even when the same file is used, the possibilities for selecting a starting position are numerous. The flexibility of the process allows the user to generate many possible random number arrays. It can therefore serve as a good tool for formatting the source data file prior to steganographically encoding a secondary data file. In other words, the process described above is a preferred preliminary process to apply before applying Main Process 2, described below.

Main Process 2

This process steganographically encodes secondary data (Confidential File) using primary data (eg. the array of pseudo-random numbers obtained from Step 32 in Main Process 1) to generate key data (Key File). Alternatively, the primary data may be obtained from a conventional random number generator or from an image, video, audio, text, or other digital data file.

In step 33 of Figure 2, the primary data array of random numbers is rearranged so as to increase the difficulty of breaking the code. The user may be provided with a wide choice of techniques for rearranging the array of random numbers so as to further increase the difficulty of hacking. The selection of the rearranging technique may be determined randomly. For example, a password may be used as a seed to generate a pseudo-random number (for example by the use of the RAND() function in the C programming language) to select a rearrangement technique. Alternatively, the user may be allowed to define or select the rearrangement technique to apply.

The technique of rearranging may be in a predefined or pseudo-random manner. Examples include: arranging in the reverse order, scanning row-by-row, column-by-column, in a zig-zag manner, or in a spiral manner, etc. Figure 3 shows an example of rearranging a typical data stream from a Container File 38 in the reverse order 39. As a further example, the spiral method involves first

taking the element at the X position, then the element at the (X+1) position, then the element at the (X-1) position, then the (X+2) position, then the (X-2) position, and so on.

The rearranging step is optional and may be omitted if it is felt that the degree of randomness introduced by applying a random number generator to the source data file is sufficient. In the preferred embodiment, the random number array is rearranged to introduce a higher degree of randomness.

In Step 34 the primary data array of random numbers may be resized to match the size of the secondary data array of second data elements contained in the Confidential File. The array of random numbers may be larger or smaller than the array of secondary data. The array of random numbers is therefore either truncated or repeated so as to match the size of the array of secondary data array. Therefore, whether this step is necessary depends on the relative sizes of the arrays and on the types of operations performed or to be performed in subsequent steps of the process.

In the event that the secondary data array is larger than the array of random numbers, all or part of the array of random numbers is repeated and the repeated random numbers may be rearranged (in Step 33) according to a different technique. In this manner, more random numbers may be provided for the subsequent operation in Step 35, described below.

In Step 35, at least one operation is performed between elements of the array of random numbers and elements of the secondary data array contained in the Confidential File. This results in a key array which contains the results of the operations.

Because each operation is between at least one random number and at least one element of the secondary data, the result obtained is different even for similar elements of the secondary data. For example, given an array of random numbers [3, 5, 2,....] and an array of second data elements [1, 3, 1,....], and supposing the operation chosen is to subtract the values of the second data elements from the random numbers, the key array obtained will be [2, 2, 1,....]. The first and third elements of the secondary data array are identical but produce different key elements because of the way in which the random numbers are

utilised in the encoding process. This is an important advantage of the invention because it makes cracking of the code more difficult.

Furthermore, the invention does not limit the user to the selection of the operation(s) to perform, thus making hacking even more difficult.

Various types of operations may be performed, including the following:

(i) A mathematical operation such as subtraction. An example of such an operation is shown in Figure 4 wherein second data elements 40 of the Confidential File are subtracted from first data elements 41 of the random number array to generate key elements 42. Other mathematical operations may include addition, multiplication, etc.

(ii) A logical operation, such as the XOR operation. Such an operation is shown in Figure 5 wherein each bit of each second data element 50 is XORed with a corresponding bit of each first data element 51 to generate a resultant bit of each key element 52.

(iii) A 1:1 mapping function. An example of such a function is illustrated in Figure 6 wherein mapping is based on the index positions as specified by the second data elements. For example, if the content of a second data element 60 has a value of "2", then "2" is taken as an index pointing to the random number 61 at position 2. The random number 61 at position 2 has a value of "98" and this is taken to be the value to be stored in the corresponding key element 62 of the key array.

The selection of operation(s) to be performed may be determined randomly. For example, a password may be used as a seed to generate a pseudo-random number (for example by the use of the RAND() function in C) to choose an operation to be performed. Alternatively, the user may be allowed to define or select the operation(s) to perform.

Referring again to Step 35 of Figure 2, the results of the operation are stored in a key array. In Step 36, information about the encoding process is stored in a header or attribute file, which is then combined in Step 37 with the key array to form a Key File. The Information Header or Attribute Section of the Key File contains all necessary information to perform the complementary decoding process. Such information may include the physical location of the Container

File, the starting position for the pseudo-random number generation process, the techniques and means of rearranging the array of random numbers, the operation performed, etc.

The encoding process may optionally include a password feature to increase security. The sender may provide a password which is also put through the encoding process. At the other end, the receiver may be prompted to enter a password and decoding is performed on the encoded password provided by the sender. Only if the decoded password matches that provided by the receiver will the decoding process proceed to reproduce the Confidential File. This process is illustrated in Figure 7 wherein a Password Array 70 containing the password "HelloWorld" is represented by the ASCII code 72, 101, 108, etc. These ASCII codes are then subtracted from the random numbers 71 to create key elements 72. These key elements are then stored in the attribute section of the Key File.

It should be understood that the data transmission application shown in Figure 1 may or may not incorporate the two-part encoding process shown in Figure 2. For example, the first main process for generating the pseudo-random number array on the Container File may be omitted. In that event, the Container File may be used as primary data in the encoding process instead of the random number array.

Further, it should be understood that the rearranging and resizing steps within the encoding process, Main Process 2, are optional and may be omitted.

It is considered that the complementary decoding process would be self evident to those skilled in the art from the information presented herein. The decoding process need not therefore be described in detail. Clearly, a key part of the decoding process is to perform an inverse operation of that performed in the encoding process. If rearranging and resizing of the primary data (ie. the random number array) has been performed in the encoding process, details must be stored in the attribute section of the Key File, or elsewhere, so that a reverse operation may be performed during the decoding process. Similarly, if a random number array has been generated from a source data file using Main Process 1, that same random number array must again be reproduced from the source data file for use in decoding of the Key File.

Advantages of the invention

A) Unrestricted secondary data size

Compared with existing steganographic or watermarking techniques the present invention has the distinct advantage that long sentences of text, large amount of data of any form, e.g. images, audio, video, binary files, may be encoded (camouflaged) and subsequently decoded in confidence.

B) No distortion in primary data or secondary data

With any form of data, e.g. images, audio, video, binary files, digital bits patterns etc., the integrity of the primary data or secondary data is never affected or compromised in any way. In other words, the decoding technique is lossless. The primary data may be optionally transmitted in any form e.g. by mail, telephone, e-mail, fax, ftp, http, dial-up networking, local area network, wide area network, Internet, intranet, or by any other electronic means. The data can also be retrieved from any storage medium, such as hard disk, floppy disk, zip disk, DAT, CD, VCD, LD, DVD. This invention has a significant advantage over the conventional methods, such as least significant bit (LSB) coding, which impose distortion to the data, thus the whole Container File must be sent. Apart from that, LSB coding allows only high bit-depth Container Files to be used, thus it is not applicable to most multimedia data.

C) Lower bandwidth usage and faster transmission

In a preferred way, since the primary data is never modified, there is no need to send or re-send the primary data for every message. Only the Key File needs to be sent. This results in reduced storage space used compared with conventional methods which require the whole Container File to be sent. Therefore, this method results in a lower bandwidth usage and faster transmission down a communication channel compared to any existing steganographic or watermarking technique.

D) Unrestricted primary data type and secondary data type

Existing steganographic and watermarking techniques usually have problems with low bit-depth bitmaps (e.g. black & white images), low bit-depth

audio and video files. This is usually due to the problem that altering the least significant bit of low bit-depth files would change the original information too much. This restricts existing steganographic or watermarking techniques to be applicable only to large bit-depth files, such as a 24-bit bitmaps, etc. However, since the present invention maintains the integrity of both the primary data and secondary data, it does not suffer from this problem and thus is able to be used for any primary data type or secondary data type.

E) Unique generated key data

The invention disclosed above has another distinct advantage in that even with the same primary data and secondary data, the generated key data is always different and unique. This makes it almost impossible for any hacker to crack the code by analysing the generated key data.

F) Different rearranging techniques

Many rearranging techniques may be implemented in this invention. This means that hackers must attempt all the rearranging techniques in order to break the code. Given that hacking a single technique is already an extremely difficult task, breaking the code becomes virtually impossible.

G) Unlimited primary data available

With the tremendous growth in Internet communication, the number of primary data files available on the Internet is practically infinite. Thus, intended users can select an image, audio, video or any digital binary file on the Internet to be used as the primary data. Thus, without the knowledge of the primary data, hackers have to try an infinite number of images, audio and video files before they can proceed with the hacking mission.

H) Password protection and a garbage-in-garbage-out system

This invention includes a garbage-in-garbage-out password protection system. The password may be used to generate the random rearranging method and/or the starting location of the primary data and or secondary data to start. Since this is designed as a garbage-in-garbage-out system, it does not give any clue as to whether the password is invalid or the primary data is invalid. Therefore, even if hackers manage to get information on the primary data file, which is already very difficult, constantly hacking the key file with various

passwords without any success may finally lead the hackers to think that the primary data file is not the right one.

l) Generation of new Container Files

Unique primary data files known only to the intended users can be easily generated. Examples of these could be a digital image of the intended users, an audio speech of the intended users, and a video clip of the intended users.

Typical Applications of the Invention

In one embodiment, the invention may be used for confidential data communication. In a preferred way, the primary data may be predetermined and the generated key file may then be transmitted to the intended users e.g. by mail, telephone, video conferencing, e-mail, fax, ftp, http, dial-up networking, Internet, Intranet, or by any other electronic means. It is found that the size of the Key File that needs to be sent is almost of equal size to the actual message, with an overhead usually of fewer than 10 bytes.

In another embodiment, the invention may be implemented as a plug-in for an Internet web browser, e-mail program, graphics program, document program or any other computer program so that confidential data can be hidden and sent only to intended users.

In yet another embodiment, software developers who want to protect their data can also apply the invention disclosed above. For example, in Microsoft® Word, the program can use the password and the document itself to hide the original data. Only the user who is able to enter the correct password would be able to view the document. Therefore, even if other programs are able to open Microsoft® Word documents, the opened document will still be presented as unintelligent data. In the same manner, this embodiment may be extended to other programs for example, an e-mail program such as Exchange™, or a graphic software such as AutoCAD®.

In a further embodiment, the invention may be used as a data verifier for the detection of modification of a sent message. The sent message in this case may be considered as the primary data while a digital signature of the sender

may be considered as the secondary data or vice versa. Upon receiving the message, the receiver can decode it to detect if the actual sender has sent it and to check if that message has been modified.

In another embodiment, confidential information or authentication codes may be stored in credit cards, passports, identity cards, cash cards, or any devices in which both primary data and secondary data exist. For example, in the case of credit cards, the biometrics (eg. photographs, fingerprints, voice, etc.) of the credit card owner may be used as the primary data while the information about the owner or his/her account or the authentication codes may be considered as the secondary data or vice versa. In such a case, if an attempt were made to change the biometrics of the credit card owner, the decoded confidential information or authentication codes would not tally.

In another embodiment, the technique may be used to generate a digital watermark in any digital image, text, audio, video or any other digital data. The image, text, audio, video or digital data may be considered as the primary data (Container File) while the digital watermark may be considered as the secondary data (Confidential File). In the encoding method, a Key File will be generated according to the invention disclosed. The rightful owner will hold the unique Key File and he can use it to decode the digital watermark from the primary data, thence proving the originality of the primary data.

In another embodiment, part of the current invention (Main Process 1 described above) may be used in the field of cryptography. In cryptography, no container file is used as in the case of steganography. Instead, a hashing function is used to decode an encrypted message. This hashing function may be a password string or a very large prime number known only to the sender and the receiver. Therefore, the pseudo-random number sequence generated using Main Process 1 can be used in place of any hashing function. Again, in view of the many possible digital files available in both the public and private domains, and the ease of making new digital files, hacking the pseudo-random number sequence will be extremely difficult if not impossible.

In yet another embodiment, the current invention may also be applied complementarily to the field of cryptography. Using the current invention, either

the hashing function or the encrypted message may be encoded and subsequently decoded for added security. Alternatively, the Key File generated using the current invention may be encrypted before transmission to the sender for subsequent decryption before being decoded steganographically.

It is anticipated that the invention will be modelled and implemented in software on general-purpose computer platforms. Alternatively, the invention may be implemented using hardwired circuitry, CPU, DSP and incorporated in one or more application specific ICs. Further, it is anticipated that the invention may be embedded into facsimile machines, telephones, digital cameras, walkie-talkies or other electronic messaging devices to enable the encoding and decoding of confidential information.

Finally, those skilled in the art will appreciate that various adaptations and modifications of the just described preferred embodiments may be configured without departing from the scope and the spirit of the invention. Therefore, it is to be understood that within the scope of the appended claims, the invention may be practiced other than as specifically described herein.

CLAIMS

1. A method of generating a pseudo-random number sequence including the steps of:

providing source data including an ordered plurality of data elements, the content of each data element being represented by a group of digits;

reading the groups of digits into an array such that each position in the array contains one of said digits;

selecting a starting position within the array of digits; and

regrouping said digits to form new groups of digits with reference to the starting position such that each new group represents a pseudo-random number and successive new groups represent said pseudo-random number sequence.

2. A method according to claim 1, further including the step of storing said pseudo-random number sequence.

3. A method according to claim 1 wherein the data elements are represented in binary notation.

4. A method according to claim 3 wherein each new group of digits includes eight binary digits.

5. A method according to claim 1 wherein the starting position is selected randomly or pseudo-randomly.

6. A method according to claim 1 wherein the starting position is selected in a pre-defined manner.

7. An encoding method utilising the pseudo-random number sequence generated by a method according to claim 1.

8. A decoding method utilising the pseudo-random number sequence

generated by a method according to claim 1.

9. An encoding method including the steps of:

providing primary data including an ordered plurality of first data elements;

providing secondary data including a plurality of second data elements; and

for each second data element

(i) performing an operation with a first data element, and

(ii) generating a key element as a result of said operation.

10. An encoding method according to claim 9 including, prior to performing said operations, the step of:

rearranging the first data elements of the primary data.

11. An encoding method according to claim 10 wherein a plurality of techniques for rearranging the first data elements is available and at least one selection is made from the plurality of techniques.

12. An encoding method according to claim 11 wherein the or each selection is made randomly or pseudo-randomly.

13. An encoding method according to claim 11 wherein the or each selection is made in a pre-defined manner.

14. An encoding method according to claim 11 including the steps of:

storing the key elements in a key file; and

storing information about the or each selected rearranging technique in an attribute section of the key file.

15. An encoding method according to claim 10 wherein the first data elements are rearranged in a predefined manner.

16. An encoding method according to claim 10 wherein the first data elements are rearranged in a random or pseudo-random manner.

17. An encoding method according to claim 9 including, prior to performing said operations, the step of:

rearranging the second data elements of the secondary data.

18. An encoding method according to claim 9 wherein the primary data is in the form of a primary data array containing the first data elements and the secondary data is in the form of a secondary data array containing the second data elements, further including the step of:

resizing the primary data array to match the size of the secondary data array.

19. An encoding method according to claim 18 wherein resizing includes the step of:

if the secondary data array is smaller than the primary data array, truncating the primary data array, and

if the secondary data array is larger than the primary data array, repeating first data elements of the primary data array.

20. An encoding method according to claim 19 including, prior to performing said operations, the step of rearranging the first data elements of the primary data array according to a first technique, and rearranging the repeated first data elements according to said first technique or further techniques other than said first technique.

21. An encoding method according to claim 9 wherein the first and second data elements are represented by numbers and wherein each operation includes a mathematical operation between the first and second data elements.

22. An encoding method according to claim 9 wherein the first and second

data elements are represented in binary notation and each operation includes a logical operation between the first and second data elements.

23. An encoding method according to claim 9 wherein the first and second data elements are represented by numbers and each operation is a mapping function.

24. An encoding method according to claim 9 wherein the first and second data elements are represented by numbers and each operation is a 1:1 mapping function wherein the content of each second data element is used as an index for selecting a first data element and the content of each selected first data element is assigned to the associated key element.

25. An encoding method according to claim 9 wherein a plurality of operations is available and a selection is made from the plurality of operations.

26. An encoding method according to claim 25 wherein the selection is made randomly or pseudo-randomly.

27. An encoding method according to claim 25 wherein the selection is made in a pre-defined manner.

28. An encoding method according to claim 9 including the step of storing the key elements in a key file.

29. An encoding method according to claim 28 including the step of storing information about the encoding process within an attribute section of the key file.

30. An encoding method according to claim 29 wherein the information stored in the attribute section includes the operation or operations performed.

31. An encoding method according to claim 28 including the step of storing

the primary data in the key file.

32. An encoding method according to claim 9 wherein the primary data includes the pseudo-random number sequence generated by a method according to claim 1.

33. An encoding method according to claim 9 wherein the primary data includes a random number sequence generated by a random number generator.

34. An encoding method according to claim 9 wherein the primary data is provided from a file obtained from the Internet.

35. An encoding method according to claim 34 including the steps of:
storing the key elements in a key file; and
storing information about the Internet file in an attribute section of the key file.

36. An encoding method according to claim 9 wherein the secondary data includes a text message and each second data element includes a character from a character set.

37. An encoding method according to claim 9 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a digital audio sample.

38. An encoding method according to claim 9 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a still image element.

39. An encoding method according to claim 9 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a motion video element.

40. A method of decoding secondary data including a plurality of second data elements, said secondary data being encoded in a plurality of key elements such that each key element is generated by an operation performed with a respective first data element of primary data, said method including the steps of:

providing said primary data including an ordered plurality of said first data elements;

providing said plurality of key elements;

for each key element, generating a corresponding said second data element by performing an inverse of said operation.

41. A method according to claim 40 wherein during encoding of the secondary data, the first data elements are rearranged according to a defined technique prior to performing the operations, said method including, prior to generating said second data elements, the step of:

rearranging the first data elements of the primary data according to said defined technique.

42. A method according to claim 41 wherein the key elements are provided in a key file having an attribute section and the attribute section contains information about said defined technique for rearranging the first data elements during the encoding of the secondary data, said method including the step of reading said information from the attribute section for determining said defined technique.

43. A method according to claim 40 wherein during encoding of the secondary data, the primary data is resized to match the size of the secondary data, said method including, prior to generating said second data elements, the step of resizing the primary data according to the resizing performed during the encoding of the secondary data.

44. A method according to claim 43 wherein during encoding of the secondary

data, the primary data is resized by truncating the primary data if the secondary data is smaller than the primary data or by repeating the primary data if the secondary data is larger than the primary data, said method including, prior to generating the second data elements, the step of:

if the primary data was truncated during encoding, truncating the primary data according to the truncating performed during the encoding of the secondary data; and

if the primary data was repeated during encoding, repeating the primary data according to the repeating performed during the encoding of the secondary data.

45. A method according to claim 44 wherein during encoding of the secondary data, the first data elements of the primary data are rearranged according to a first technique and repeated first data elements are rearranged according to said first technique or further techniques other than said first technique, said method including, prior to generating said second data elements, the step of rearranging the first data elements of the primary data array according to said first technique, and rearranging the repeated first data elements according to said first technique or said further techniques.

46. A method according to claim 40 wherein the key elements are provided in a key file having an attribute section and the attribute section contains information about the operations performed during the encoding of the secondary data, said method including the step of reading said information from the attribute section for determining for each key element said inverse of said operation.

47. A method according to claim 40 wherein during encoding of the secondary data, the primary data is provided from a file obtained from the Internet, and the key elements are provided in a key file having an attribute section which contains information about the Internet file, said method including the step of reading said information from the attribute section for retrieving said Internet file.

48. A method according to claim 40 wherein the primary data includes a pseudo-random number sequence generated by a method according to claim 1.

AMENDED CLAIMS

[received by the International Bureau on 08 April 2000 (08.04.00) ;
original claims 1-48 replaced by new claims 1-45 (8 pages)]

CLAIMS

1. An encoding method including steps of:

providing primary data including an ordered plurality of first data elements;

providing secondary data including a plurality of second data elements;

and

for each second data element

(i) performing an operation with a first data element, and

(ii) generating a key element as a result of said operation;

wherein each operation is performed and each key element is generated without degrading said primary data.

2. An encoding method according to claim 1 including, prior to performing said operations, a step of:

rearranging the first data elements of the primary data.

3. An encoding method according to claim 2 wherein a plurality of techniques for rearranging the first data elements is available and at least one selection is made from the plurality of techniques.

4. An encoding method according to claim 3 wherein the or each selection is made randomly or pseudo-randomly.

5. An encoding method according to claim 3 wherein the or each selection is made by a user.

6. An encoding method according to claim 3 including steps of:

storing the key elements in a key file; and

storing information about the or each selected rearranging technique in an attribute section of the key file.

7. An encoding method according to claim 2 wherein the first data elements are rearranged in a predefined manner.

8. An encoding method according to claim 2 wherein the first data elements are rearranged in a random or pseudo-random manner.

9. An encoding method according to claim 1 including, prior to performing said operations, a step of:

rearranging the second data elements of the secondary data.

10. An encoding method according to claim 1 wherein the primary data is in the form of a primary data array containing the first data elements and the secondary data is in the form of a secondary data array containing the second data elements, further including a step of:

resizing the primary data array to match the size of the secondary data array.

11. An encoding method according to claim 10 wherein resizing includes a step of:

if the secondary data array is smaller than the primary data array, truncating the primary data array, and

if the secondary data array is larger than the primary data array, repeating first data elements of the primary data array.

12. An encoding method according to claim 11 including, prior to performing said operations, a step of rearranging the first data elements of the primary data array according to a first technique, and rearranging the repeated first data elements according to said first technique or further techniques other than said first technique.

13. An encoding method according to claim 1 wherein the first and second data elements are represented by numbers and wherein each operation includes a mathematical operation between the first and second data elements.

14. An encoding method according to claim 1 wherein the first and second data elements are represented in binary notation and each operation includes a logical operation between the first and second data elements.

15. An encoding method according to claim 1 wherein the first and second data elements are represented by numbers and each operation is a mapping function.

16. An encoding method according to claim 1 wherein the first and second data elements are represented by numbers and each operation is a 1:1 mapping function wherein the content of each second data element is used as an index for selecting a first data element and the content of each selected first data element is assigned to the associated key element.

17. An encoding method according to claim 1 wherein a plurality of operations is available and a selection is made from the plurality of operations.

18. An encoding method according to claim 17 wherein the selection is made randomly or pseudo-randomly.

19. An encoding method according to claim 17 wherein the selection is made by a user.

20. An encoding method according to claim 1 including a step of storing the key elements in a key file.

21. An encoding method according to claim 20 including a step of storing information about the encoding process within an attribute section of the key file.

22. An encoding method according to claim 21 wherein the information stored in the attribute section includes the operation or operations performed.

23. An encoding method according to claim 20 including a step of storing the primary data in the key file.

24. An encoding method according to claim 1 wherein the primary data includes a pseudo-random number sequence generated by a method including steps of:

providing said ordered plurality of first data elements, the content of each data element being represented by a group of digits;

reading the groups of digits into an array such that each position in the array contains one of said digits;

selecting a starting position within the array of digits; and

regrouping said digits to form new groups of digits with reference to the starting position such that each new group represents a pseudo-random number and successive new groups represent said pseudo-random number sequence.

25. A method according to claim 24, wherein said method for generating said pseudo-random number sequence includes a step of storing said pseudo-random number sequence.

26. A method according to claim 24 wherein the data elements are represented in binary notation.

27. A method according to claim 26 wherein each new group of digits includes eight binary digits.

28. A method according to claim 24 wherein the starting position is selected randomly or pseudo-randomly.

29. A method according to claim 24 wherein the starting position is selected in a pre-defined manner.

30. An encoding method according to claim 1 wherein the primary data includes a random number sequence generated by a random number generator.

31. An encoding method according to claim 1 wherein the primary data is provided from a file obtained from the Internet.

32. An encoding method according to claim 31 including steps of:
storing the key elements in a key file; and
storing information about the Internet file in an attribute section of the key file.

33. An encoding method according to claim 1 wherein the secondary data includes a text message and each second data element includes a character from a character set.

34. An encoding method according to claim 1 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a digital audio sample.

35. An encoding method according to claim 1 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a still image element.

36. An encoding method according to claim 1 wherein the first data elements are arranged in an array and each first data element represents a characteristic associated with a motion video element.

37. A method of decoding secondary data including a plurality of second data elements, said secondary data being encoded in a plurality of key elements generated by an operation performed with a respective first data element of primary data, wherein each operation is formed and each key element is generated without degrading said primary data, said method including steps of:

providing said primary data including an ordered plurality of said first data elements;

providing said plurality of key elements; and

for each key element, generating a corresponding said second data element by performing an inverse of said operation.

38. A method according to claim 37 wherein during encoding of the secondary data, the first data elements are rearranged according to a defined technique prior to performing the operations, said method including, prior to generating said second data elements, a step of:

rearranging the first data elements of the primary data according to said defined technique.

39. A method according to claim 38 wherein the key elements are provided in a key file having an attribute section and the attribute section contains information about said defined technique for rearranging the first data elements during the encoding of the secondary data, said method including a step of

reading said information from the attribute section for determining said defined technique.

40. A method according to claim 37 wherein during encoding of the secondary data, the primary data is resized to match the size of the secondary data, said method including, prior to generating said second data elements, a step of resizing the primary data according to the resizing performed during the encoding of the secondary data.

41. A method according to claim 40 wherein during encoding of the secondary data, the primary data is resized by truncating the primary data if the secondary data is smaller than the primary data or by repeating the primary data if the secondary data is larger than the primary data, said method including, prior to generating the second data elements, a step of:

if the primary data was truncated during encoding, truncating the primary data according to the truncating performed during the encoding of the secondary data; and

if the primary data was repeated during encoding, repeating the primary data according to the repeating performed during the encoding of the secondary data.

42. A method according to claim 41 wherein during encoding of the secondary data, the first data elements of the primary data are rearranged according to a first technique and repeated first data elements are rearranged according to said first technique or further techniques other than said first technique, said method including, prior to generating said second data elements, a step of rearranging the first data elements of the primary data array according to said first technique, and rearranging the repeated first data elements according to said first technique or said further techniques.

43. A method according to claim 37 wherein the key elements are provided in a key file having an attribute section and the attribute section contains information about the operations performed during the encoding of the secondary data, said method including a step of reading said information from the attribute section for determining for each key element said inverse of said operation.

44. A method according to claim 37 wherein during encoding of the secondary data, the primary data is provided from a file obtained from the Internet, and the key elements are provided in a key file having an attribute section which contains information about the Internet file, said method including a step of reading said information from the attribute section for retrieving said Internet file.

45. A method according to claim 37 wherein the primary data includes a pseudo-random number sequence generated by a method including steps of:

providing said ordered plurality of first data elements, the content of each data element being represented by a group of digits;

reading the groups of digits into an array such that each position in the array contains one of said digits;

selecting a starting position within the array of digits; and

regrouping said digits to form new groups of digits with reference to the starting position such that each new group represents a pseudo-random number and successive new groups represent said pseudo-random number sequence.

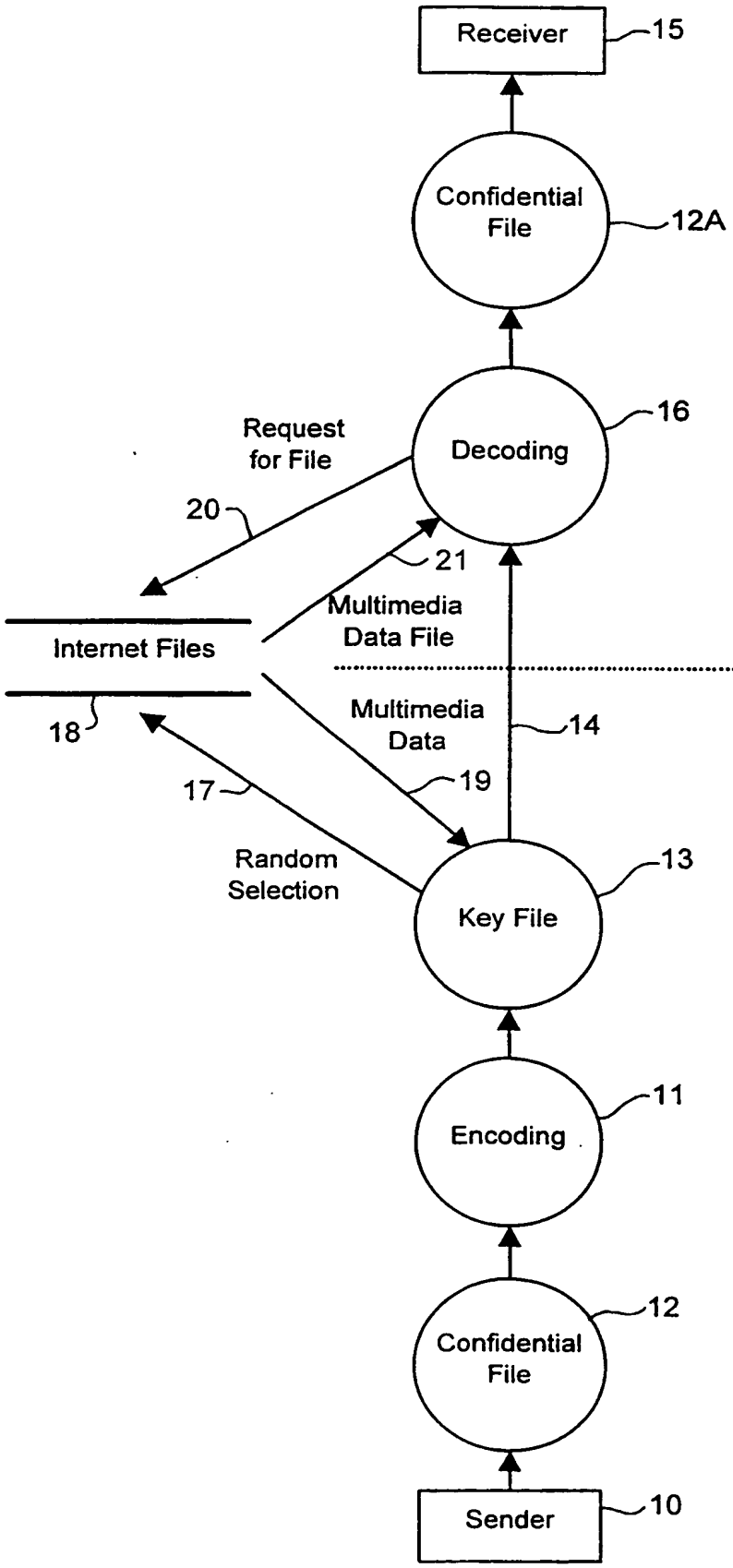
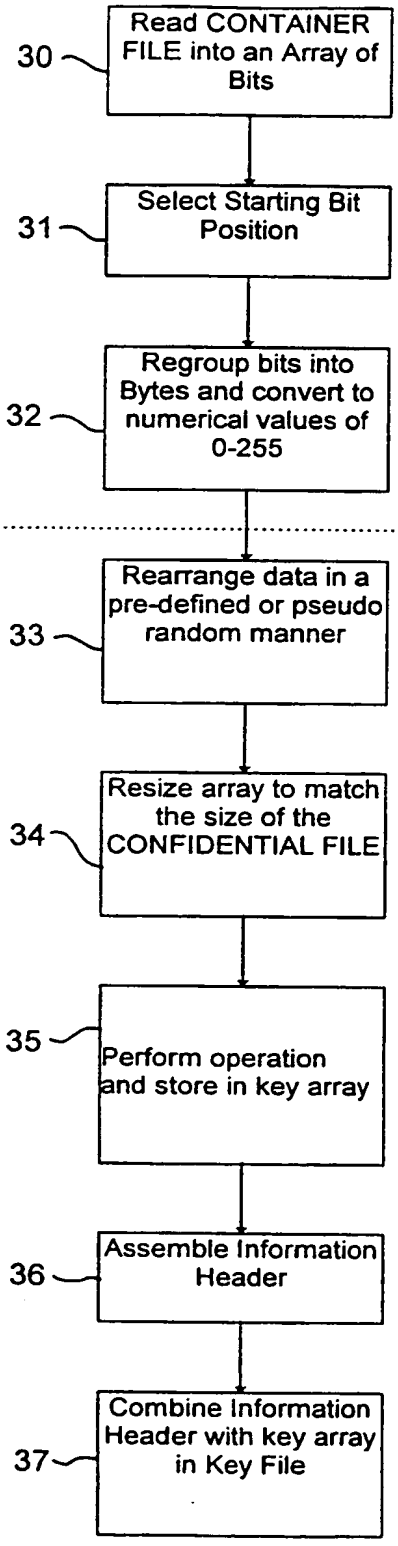

Receiver
15
Confidential File
12A
Decoding
16
Request for File
20
21
Multimedia Data File
Internet Files
18
Multimedia Data
14
19
17
Random Selection
Key File
13
Encoding
11
Confidential File
12
Sender
10

FIG 1



Main Process 1

Main Process 2

FIG 2

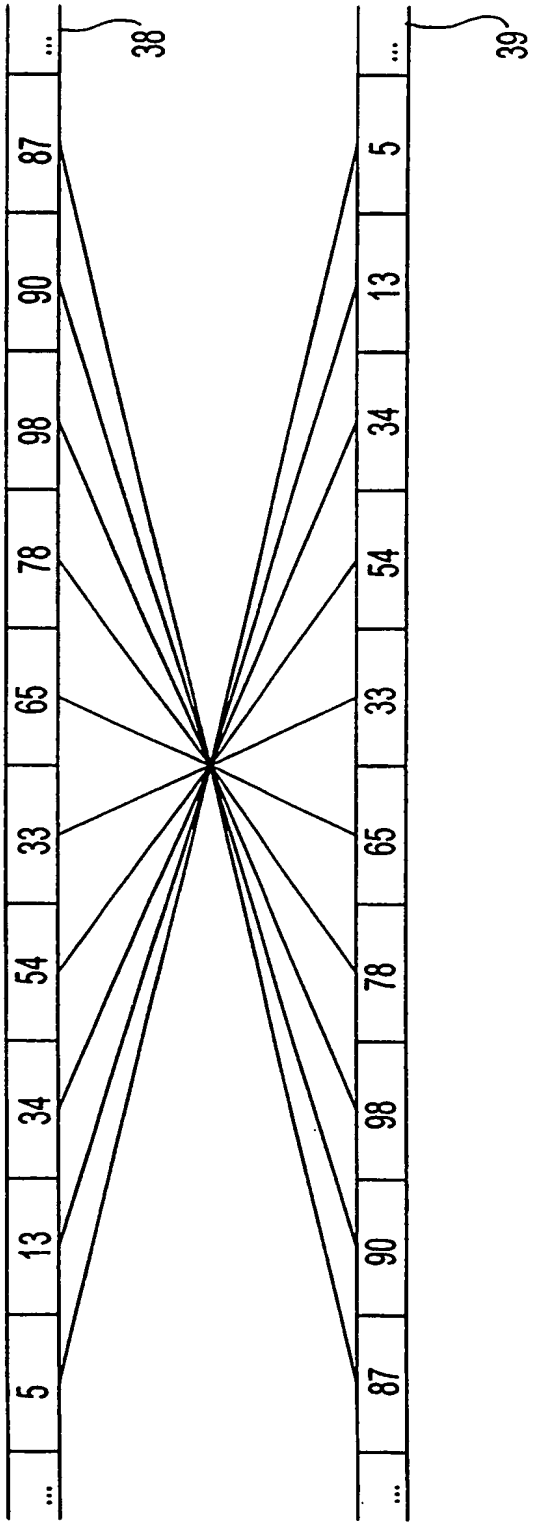


FIG 3

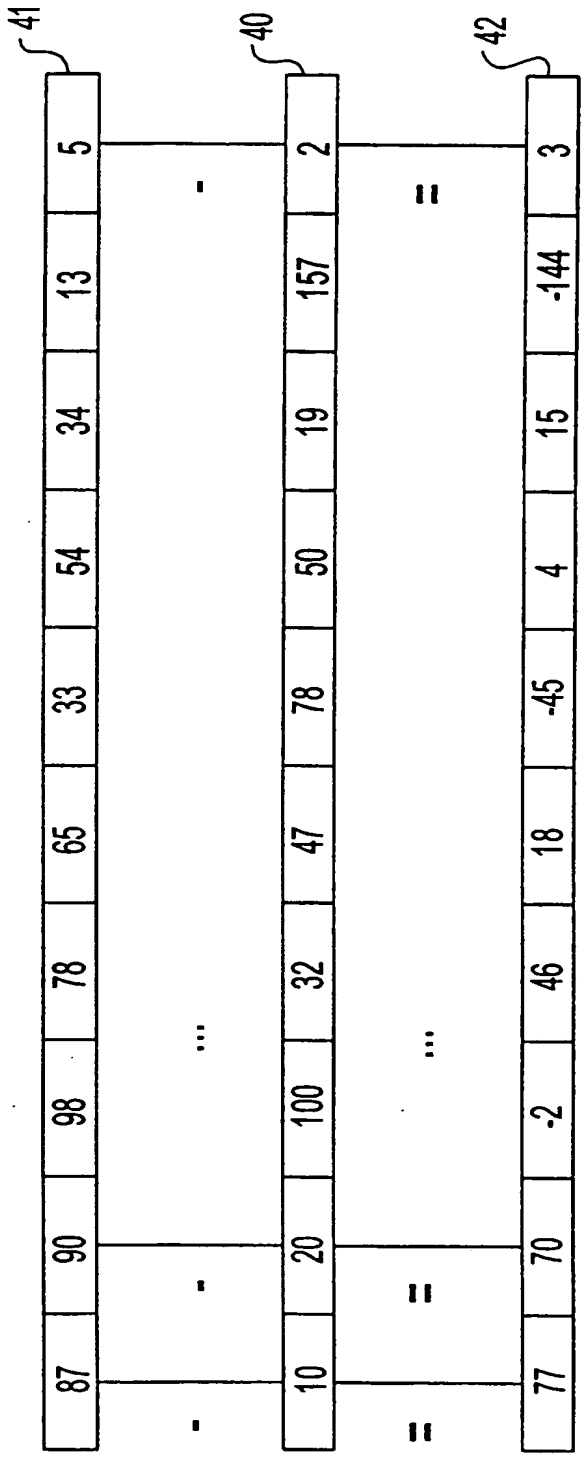

41
40
42
5
13
34
54
33
65
78
98
90
87
2
157
19
50
78
47
32
100
20
10
3
-144
15
4
-45
18
46
-2
70
77

FIG 4

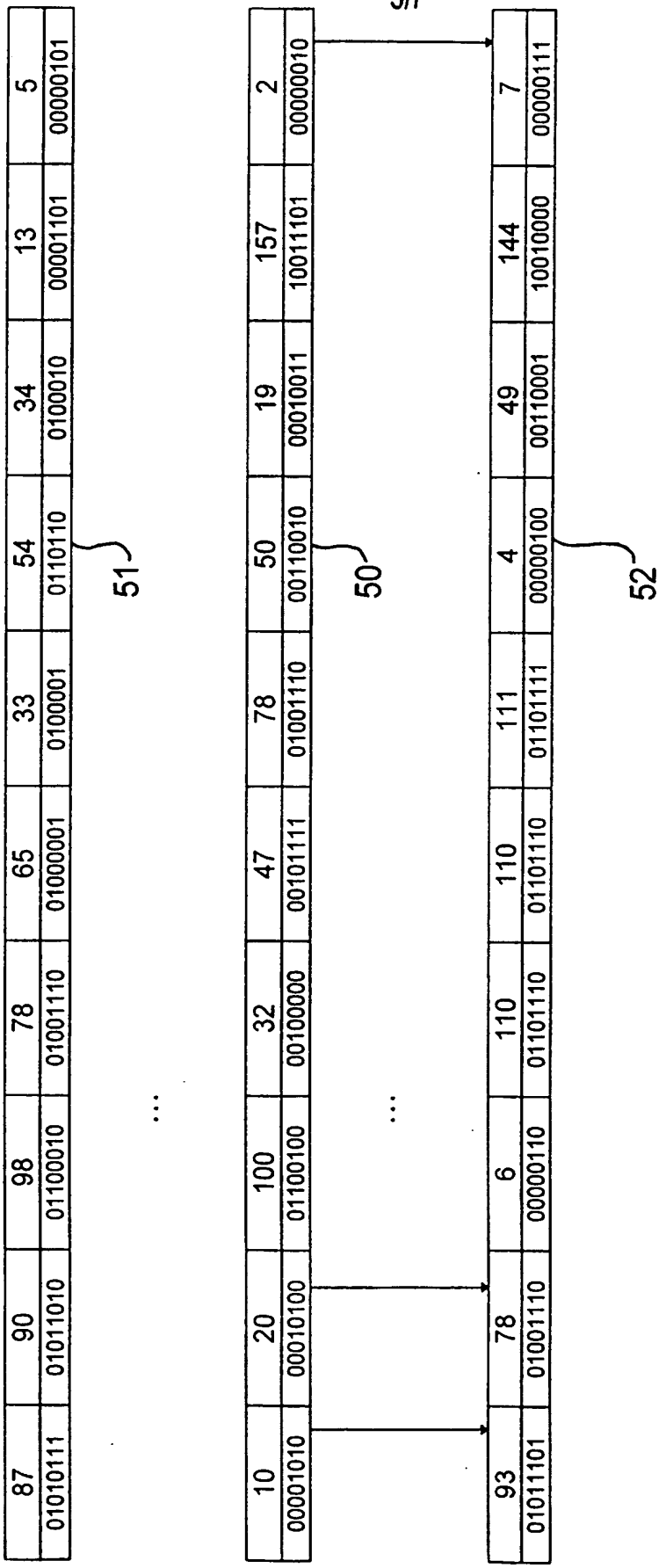

87 90 98 78 65 33 54 34 13 5
01010111 01011010 01100010 01001110 01000001 01100001 01110110 01100010 00001101 00000101
51
10 20 100 32 47 78 50 19 157 2
00001010 00010100 01100100 00100000 00101111 01001110 00110010 00010011 10011101 00000010
50
93 78 6 110 110 111 4 49 144 7
01011101 01001110 00000110 01101110 01101110 01101111 00000100 00110001 10010000 00000111
52

FIG 5

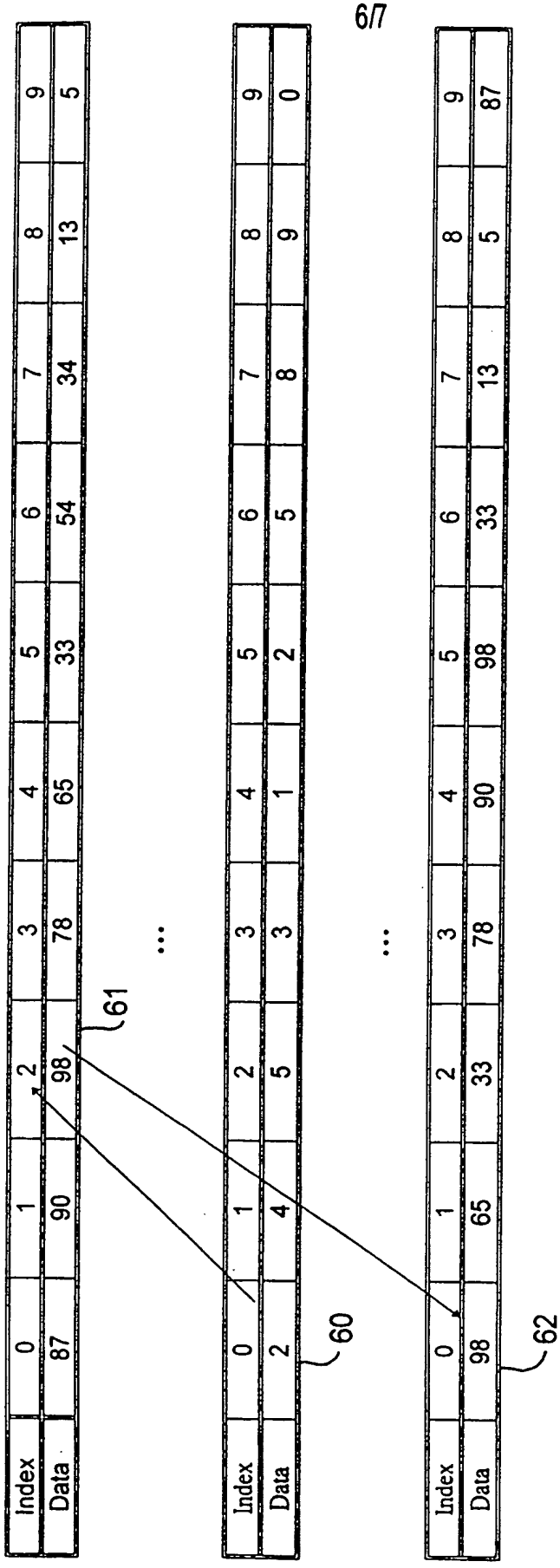


FIG 6

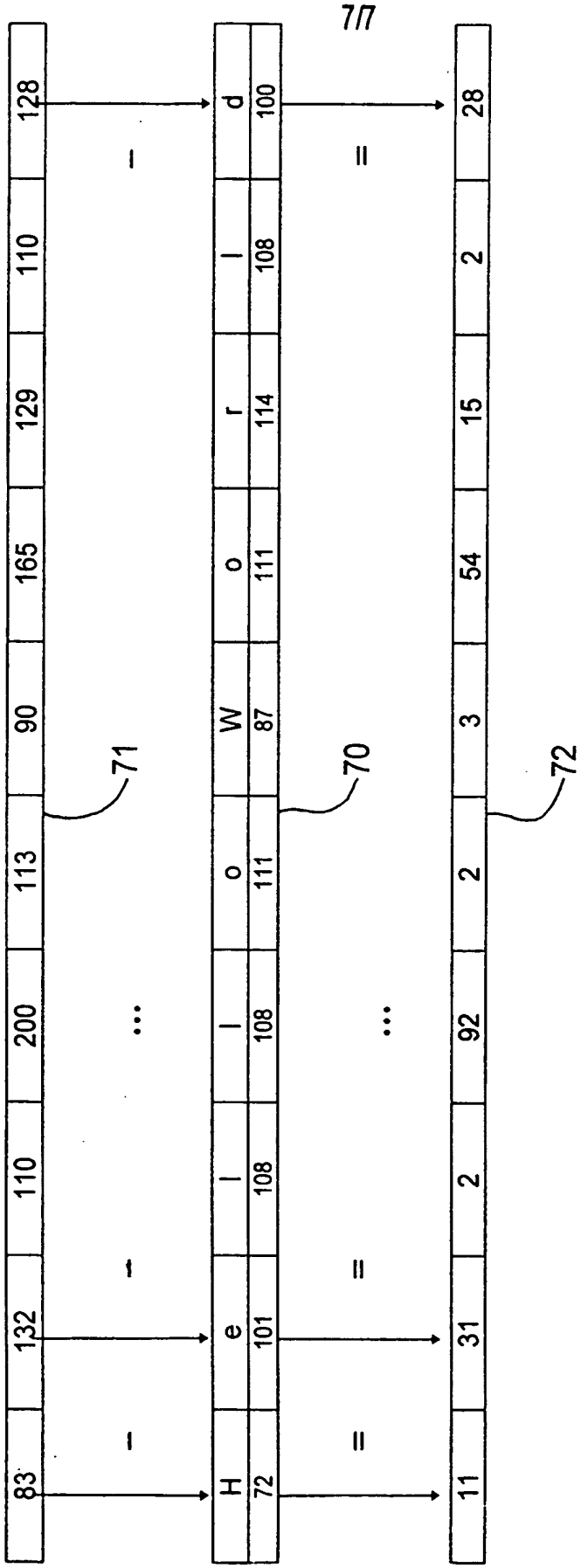

7/7
128
110
129
165
90
113
200
110
132
83
d
l
r
o
W
o
l
l
e
H
100
108
114
111
87
111
108
108
101
72
28
2
15
54
3
2
92
2
31
11
71
70
72
–
–
–
–
=
=
=
...
...

FIG 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG 99/00105

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: G06F 7/58, H04L 9/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC G06F 7/-, H04L 9/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96/42151 A (THE DICE COMPANY) 27 December 1996 pages 14-19	9-11, 17, 21-23, 25, 37-41, 43
A	US 5276738 A (HIRSCH) 4 June 1994 Whole document	9-48
A	EP 301383 A (ADVANTEST CORPORATION) 19 July 1988 Whole document	1-8

☐ Further documents are listed in the continuation of Box C

☒ See patent family annex

* Special categories of cited documents:

"A" Document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
27 January 2000

Date of mailing of the international search report
11 FEB 2000

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200
WODEN ACT 2606 AUSTRALIA
E-mail address: pct@ipaustralia.gov.au
Facsimile No.: (02) 6285 3929

Authorized officer

J. LAW
Telephone No.: (02) 6283 2179

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/SG 99/00105

Box 1 Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-8 are directed to a method of generating a pseudo-random number sequence, where a starting position of an array of digits is first selected, the digits are then regrouped with reference to the selected starting position so as to form a pseudo-random number.

2. Claims 9-48 are directed to an encoding / decoding method, where a key element is generated by performing an operation between each primary data element with a secondary data element.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SG 99/00105

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	96/42151	EP	872073	US	5613004	US	5687236
US	5276738	EP	614147				
EP	301383	JP	1036212	US	5901264	JP	1036213

END OF ANNEX